

Patent claims

1. Microcapsules made of a core which contains at least one rubber additive and of at least one shell made of a first polymer,

characterised in that

at least one coating made of a second polymer, which differs from the first polymer, and/or of a low molecular inorganic or organic compound, is deposited on the surface of the microcapsules as sliding or wearing layer in order to reduce the static friction.

2. Microcapsules according to claim 1,
characterised in that
the shell is mechanically stable and thermally stable up to at least 120°C.
3. Microcapsules according to at least one of the preceding claims,
characterised in that
the rubber additive can be released in a controlled manner under vulcanisation conditions.
4. Microcapsules according to at least one of the preceding claims,
characterised in that
the rubber additive is ground or liquid sulphur.
5. Microcapsules according to at least one of the preceding claims,
characterised in that
the sulphur proportion of the microcapsules is more than 50% by weight, preferably between 80 and 95% by weight.
6. Microcapsules according to at least one of the preceding claims,
characterised in that

the first polymer is selected from the group of amino resins, such as dicyandiamide formaldehyde resin or melamine formaldehyde resin or phenol formaldehyde resin.

7. Microcapsules according to at least one of the preceding claims, characterised in that
the second polymer is selected from the group of polyacrylates, polyacrylnitriles, polyethyleneglycols, ethylcelluloses, starch fatty acid esters and starch carbamates of long-chain isocyanates.
8. Microcapsules according to at least one of the preceding claims, characterised in that
the low molecular inorganic or organic compound is selected from the group of waxes, fatty acid derivatives, silicones, siloxanes and silicates.
9. Microcapsules according to at least one of the preceding claims, characterised in that
the average particle diameter of the microcapsules is between 1 and 50 μm , preferably between 5 and 20 μm .
10. Microcapsules according to at least one of the preceding claims, characterised in that
the shell has a thickness between 30 and 100 nm.
11. Microcapsules according to at least one of the preceding claims, characterised in that
the shell and the at least one coating together have a thickness between 40 and 200 nm.
12. Method for producing microcapsules made of a core which contains at least one rubber additive, of a shell or shells made of a first

polymer and of at least one sliding or wearing layer with the following steps:

- a) dispersing the rubber additive in a prepolymer solution forming the first polymer,
 - b) curing the microcapsule chemically, e.g. by the addition of a catalyst and/or by increasing the temperature,
 - c) depositing at least one sliding or wearing layer made of a second polymer, which differs from the first polymer, and/or of a low molecular inorganic or organic compound on the surface of the microcapsule.
13. Method according to claim 12, characterised in that ground or liquid sulphur is used as rubber additive.
 14. Method according to at least one of the claims 12 or 13, characterised in that a reactive resin selected from the group melamine formaldehyde resin or phenol formaldehyde resin is used as first polymer.
 15. Method according to at least one of the claims 12 to 14, characterised in that, after the curing in step b), the microcapsules are separated from the prepolymer solution.
 16. Method according to at least one of the claims 12 to 15, characterised in that, after the thermally and/or chemically induced curing, a second shell made of the first polymer is applied.

17. Method according to at least one of the claims 12 to 16,
characterised in that
the second polymer is deposited by means of coacervation, solvent
evaporation, salting-out or spray-drying.
18. Method according to at least one of the claims 12 to 17,
characterised in that
the low molecular inorganic or organic compound is deposited from
organic solution or aqueous dispersion.
19. Method according to claim 18,
characterised in that
the sliding or wearing layer is deposited by spraying processes.
20. Method according to at least one of the claims 12 to 19,
characterised in that
the microcapsule, during deposition in step c), is granulated by
means of the second polymer and/or the low molecular inorganic or
organic compound.
21. Method according to at least one of the claims 12 to 20,
characterised in that
the microcapsule, after deposition in step c), is granulated by means
of a granulation aid.
22. Use of the microcapsules according to at least one of the claims 1 to
11, for rubber vulcanisation.